

NOTES ON THE RECENT LIMESTONES ON PARTS OF THE SOUTH AND WEST COASTS OF CAPE COLONY.

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WITH PLATE X.

ROUND the west and south coasts of the Colony, from St. Helena Bay to the mouth of the Breede River, there are more or less extensive deposits of a sandy limestone. It is the purpose of this paper to describe the rock found within these limits, excluding that of parts of the shores of Table and False Bays.

These rocks have not had much attention paid them by previous observers. They are mentioned by Clarke * and Green,† but the only accounts of them we have noticed are those by Andrew Bain ‡ and Hochstetter; Bain recorded one of their chief characters, that they contain large numbers of a common land snail.

Hochstetter § described the limestones of the Peninsula and Robben Island, and came to the conclusion that they were formed by carbonate of lime cementing together debris piled up by wind and waves.

Dunn || put them in at one or two localities on his maps as Tertiary beds.

It is only on steep shores which drop suddenly into fairly deep water that little or no calcareous rock is found. The chief instance of this is the coast between Gordon's Bay and Kogel Bay, where the Table Mountain sandstone forms a steep foreshore.

The rock is made up of grains of sand imbedded in a calcareous matrix. Sometimes there are numerous fragments of marine shells, including some whole ones, but these are rare. It is impossible to

* Clarke, Proc. Geol. Soc., Lond., iii., p. 418.

† Green, A. H., Quart. Journ., Geol. Soc., Lond., xlv., p. 239.

‡ Bain, A. G., Trans. Geol. Soc., Lond., ser. 2, vol. vii., part iv., p. 175.

§ v. Hochstetter, Reise der Oster., Frig., Novara um die Erde. Geol. Theil., p. 19. Vienna, 1886.

|| Dunn, E. J., Geological Sketch Map of S. Africa, 1887 and an earlier edition.

draw a hard and fast line between the calcareous rock and the sand which lies near it, although it is certain that while parts of the limestone are of very considerable age, reckoning by years, near at hand a similar rock is forming to-day.

Where exposed to the weather, either inland or on the beach, the limestone is often extremely hard, but this indurated rock is of small thickness, and rapidly graduates into a soft stone beneath, which may be dug out with a spade. At Hoetjes Bay, where the limestone has been largely quarried, there may be seen every intermediate variety of rock between one which rings when struck with a hammer and one which crumbles when touched. While the bulk of the calcareous matter of the rock is formed of comminuted marine shells, or of carbonate of lime derived from them, large numbers of unbroken land shells occur in many localities distributed fairly uniformly through the rock. Broken or abraded specimens are very rarely seen, thus contrasting strongly with the marine shells. Accompanying the snail shells are frequently found bones of mammals, such as the elephant, rhinoceros, different kinds of buck, and carnivora. The bones are not water-worn, but in good condition so far as outward form is concerned. At the Hoetjes Bay quarry a layer of rootlets was exposed at the time of our visit, some twenty feet below the present surface. These are facts which point to the deposit having been formed on land.

The limestone always shows some trace of bedding planes; the beds may be of considerable thickness, or the rock may vary in character four times in a thickness of one inch.

Where the layers are thin the rock is generally false bedded; the action of wind and rain brings out this structure very clearly, as the softer layers are eaten away and the harder ones stand out in strong relief. Very fine examples of this occur in the cliff sections on the south coast; in one place the layers, perhaps, will all be straight, and one set will meet another set at a high angle; at another place the layers will be curved and may abut almost at right angles against the overlying stratum, or the curved layers may thin out and wedge between two other strata.

In the Saldanha Bay district the limestone is found as a bank of rock lying on the ground which slopes down towards the shore; occasionally a kopje of the underlying granite appears through the limestone. As the distance from the shore increases outcrops of limestone become less numerous in hilly country, as that between Saldanha and St. Helena Bays, where a range of granite hills occurs. On the other hand, where the ground is low-lying and the

slopes are gentle, as in the wide tract of open country east and north-east of Saldanha Bay, the limestone forms a continuous covering which gradually disappears at a distance of from five to twenty miles from the coast. Streams have sometimes cut through the limestone and laid bare the underlying rock.

At Hoetjes Bay quarry about 50 ft. of limestone are seen in section. Near Langebaan cliffs of an equal or greater height have been cut in the rock, which in both localities descends below the level of low tides.

At Paternoster a well was sunk 70 ft. through the rock on the low ground near the shore before the underlying rock was reached.

Near North-West Bay the limestone forms a prominent ridge, like a line of sand-dunes, at a short distance from the shore. This mode of occurrence is much more frequently met with on the south coast.

Southwards from Saldanha Bay, round Yzer Fontein Point to the shores of Table Bay, there is much limestone and blown sand, but they offer no special features for remark.

On the south coast limestone covers extensive areas between the mouths of the Bot and Breede Rivers.

There are striking hill ranges of the rock near the Klein River, between Uilenkraal River and Carruthers' Hill, west of Zout Anysberg, north of Cape Agulhas, south-west of Bredasdorp, and between that village and Cape Infanta.

The limestone also occurs in less conspicuous patches, and as a general covering more or less continuously along the coast.

The hill ranges are not simple ridges, but are made up of collections of ridges separated by longitudinal valleys, in which the underlying rock is never seen.

The limestone composing the hills is bedded, and in every good section false bedding can be seen (Plate X., and fig. 1).

The trend of the hills is more or less parallel with the nearest shore line.

In addition to the longitudinal valleys separating the component hills of a range there are transverse ones; some of these are occupied by rivers that flow from the country behind the range, which is considerably lower than the average height of the range itself. Instances of such valleys are seen along the Uilenkraal and Bushman Rivers near Danger Point, and in those parts of the Kars and Salt Rivers north-east of Bredasdorp. Smaller transverse kloofs drain the hills to the north and south.

The largest hill range is that which stretches from Bredasdorp north-eastwards to Cape Infanta. Honing Rug, south-west of Bredasdorp is really a continuation of this range.

Near Bredasdorp the range is about eight miles from the coast, but it gradually approaches the latter towards the east, until it finally forms cliffs above the shore between Cupido's Kraal and Cape Infanta. The range is over five miles wide in parts, and probably exceeds 500 ft. in height; it forms a barrier between the "Duine," as the low-lying country between it and the sea is called, and the "Ruggens." Both on the north and the south side it rises by steep slopes like escarpments, and is traversed by deep kloofs running parallel with the general trend of the range. On the north, the

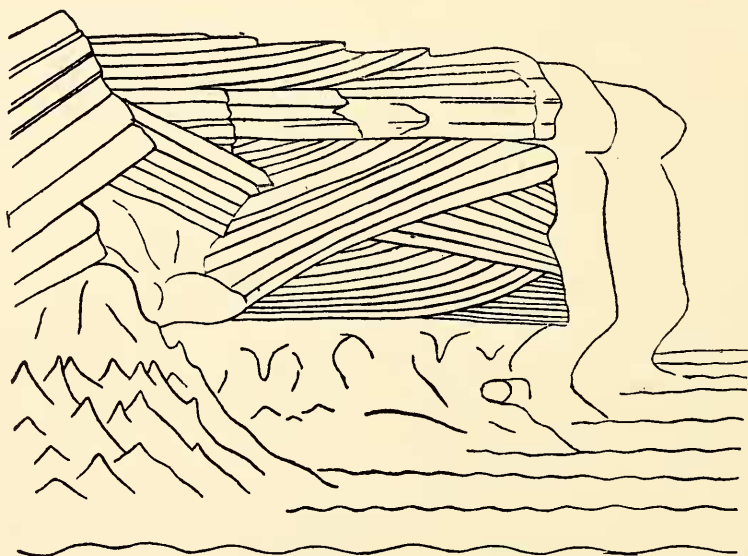


FIG. 1.—FALSE-BEDDED LIMESTONE, WAAGEN-HUIS KRANTZ.

Ruggens are of the usual undulating type of country, but on the south of the range the land is remarkably flat, resembling a shore-terrace. The level country is now covered by thin limestones and sand-dunes, through which the same rocks which form the Ruggens, namely the Bokkeveld and Witteberg beds, occasionally appear. Along the present coast-line the sand-dunes, in places transformed into limestone, are very similar in mode of occurrence to the inland limestone range of Bredasdorp, and it is possible that the latter was similarly formed along an ancient coast-line, and that the sea has since receded. At any rate it is beyond question that the inland limestone ranges are of a much more ancient date than those along the present coast.

As regards the origin of the limestone, its contents point to its having been formed on land, while the form and manner of occurrence of the more prominent areas make it probable that they are consolidated sand dunes.

A sample of the stone from Saldanha Bay, used in the new post-office building, Cape Town, was analysed by Mr. Watermeyer, and found to consist of—

Carbonate of Lime	..	..	..	..	85.32
,, Iron	..	..	..	..	1.69
Silica	..	..	..	..	12.96
					99.98

This is the only analysis known to us, but the composition certainly varies considerably owing to the presence of a greater or less amount of quartz sand.

The shifting sand-dunes along the coast afford good opportunities for comparison. In these dunes the formation of false bedding is often seen in progress, and may be explained somehow as follows: Wind of a certain velocity carries sand grains of a certain weight; if it increases the sand grains will be heavier, if it diminishes these will be lighter. On a growing sand-dune, where the wind is depositing its burden, the succeeding layers of grains will vary slightly in character as the wind varies in velocity, and in this way distinct bedding is produced. The sand is usually deposited on a slope, and when the wind changes in direction the new layers consequently form at an angle to the older ones, and false-bedding results.

The alternating layers of slightly different particles offering various resistances to the wind cause the structure of the dune to show up well in places where a section through the dune is being cut, owing to a change in the force or direction of the wind. In the sand-dunes bones and skulls of various land animals are also found accompanied by fragments of marine shells blown up from the beach. If such a range of sandhills as that which lies just above the shore from Cape Agulhas to Cupido's Kraal, were hardened by the deposition of carbonate of lime within it, the result would be a range of limestone hills very like the Bredasdorp one.

In sheltered spots amongst the sandhills the surface is hardened in this manner, and the same is the case to a lesser extent on some slopes of the dunes themselves.

The sand-dunes are composed of grains of quartz and other minerals derived from the disintegration of the land, mixed with

enormous numbers of minute fragments of shells, made of carbonate of lime. When rain-water falls on the sand it sinks in and dissolves some of this carbonate of lime. The saturated sand then loses its water partly by evaporation at the surface, partly owing to the water sinking through it and running off at the first opportunity. The water lost by evaporation at the surface will leave behind any dissolved carbonate of lime that it has taken up during its stay in the sand as a deposit round the grains near the surface. This, no doubt, accounts for the rapid hardening of calcareous sands where exposed to the weather. It is probable that a slow process of solution and redeposition of carbonate of lime goes on continually throughout the deeper-seated parts of calcareous sand-dunes.

The present position of the Bredasdorp and other limestone ranges, which are at a considerable height above sea-level, must be due to a change in level since their formation. The ground between the hills and the shore is remarkably flat, when the modern sand-dunes are left out of consideration. The absence of definite ridges of moving sands at such a distance from the shore at the present time, makes it difficult to understand what could have caused them in former times. If, however, we take the limestone ranges to be of the same nature as the modern lines of dunes along the coast, the difficulty vanishes.

There is, however, other evidence of a change in level along the south coast within recent times.

The rock shelf, which is found conspicuously developed between Mudge Point and Zout Anysberg, is extremely difficult to explain otherwise than as a raised beach. The shelf is cut for the most part in hard quartzite, and the contrast between the flat ground near the shore, with the numerous smooth outcrops of quartzite, and the rugged surfaces which the same rock shows in the hills rising abruptly on the landward edge of the terrace is very striking.

Near Uilenkraal River, and also near Zout Anysberg, the limestone hills lie at the back of such terraces, and outlying patches of the rock are found perched high up on the adjacent hills of Table Mountain sandstone, in such positions that could hardly be reached by sand-dunes under present conditions.

Near Cape Infanta the cliffs are formed of Table Mountain sandstone on the lower half and of limestone on the upper; near the base of the latter, or about 100 ft. above sea-level, there is a bed of large pebbles, while a similar, or perhaps the same bed, is seen on the surface of the ground near the head of a ravine which cuts right through the limestone in the same neighbourhood (fig. 2). This

conglomerate probably represents a beach. Other conglomerates are met with at the base of the limestone near Uilenkraal River and Struys Point.

A few large marine shells, such as the oyster, were found in the limestone of Honing Rug, and we were informed that a bed containing such shells was to be seen in a ravine in the Bredasdorp range, although we did not come across it. The presence of a few large marine shells is not in itself good evidence for any one mode of origin of a recent deposit, for man may have carried them to the spot where they are found.

From all the evidence, however, at present obtained one is led to conclude that the limestone hills were once sand-dunes near the shore, and that they have been raised relatively to the sea-level together with the rock they rest on. The amount of elevation is not known exactly, but it is probably between 50 ft. and 100 ft. The elevation did not take place all at once, but extended throughout a considerable lapse of time, and was almost certainly interrupted by periods of subsidence. A study of the limestone along the coast seems to prove this, for at Waagen-huis Krantz, and north of the Kellers by Danger Point, the limestone which has certainly been formed on land is seen exposed beneath low-water mark, and can only have reached its present level by a relative sinking of the land. Evidence of the same nature is also obtainable at Saldanha Bay.

The mammalian bones, known to us from the limestone or associated sand, up to the present time have been briefly examined by Messrs. Sclater and Péringuey, who consider that they all belong to living species, although some of them no longer live in the districts where the bones were found. Mr. Lightfoot named a collection of snail shells from the Saldanha Bay limestone, and found that they all belonged to species living in that district.

The localities where we obtained bones are Hoetjes Bay and Linkerhand's Gat near Stanford, but they must occur at many other places. Mr. Thwaites, the R.M. of Bredasdorp, gave the Museum some fine specimens from the sand-dunes of Struys Bay, including skulls of a rhinoceros and hartebeest, and an elephant's jaw.

There are some interesting caves in the limestone (fig. 2). Many small ones have been formed by the action of the weather and waves along the coast. In the ravines cut through the Downs caves of all sizes are formed by the weathering of soft rock underlying a harder layer. These sometimes contain deposits of guano due to bats and rock rabbits, which would be very valuable were it not for the difficulty of access.

On the coast near Cape Infanta there is a large cave, opening by a small hole on the face of a great limestone cliff. The upper part of the cliff overhangs very considerably, and long stalactites hang from it. The interior of the cave must be at least 20 ft. high in parts. The roof is entirely formed of stalactites from which water constantly drops. The floor is of sand and guano. This cave is situated near the bottom of the limestone, and at the entrance is seen the boulder bed already mentioned as being probably a beach. The length and breadth of the cave are not great, probably less than 50 yards. The general appearance of the interior is very like that of the Congo cave.

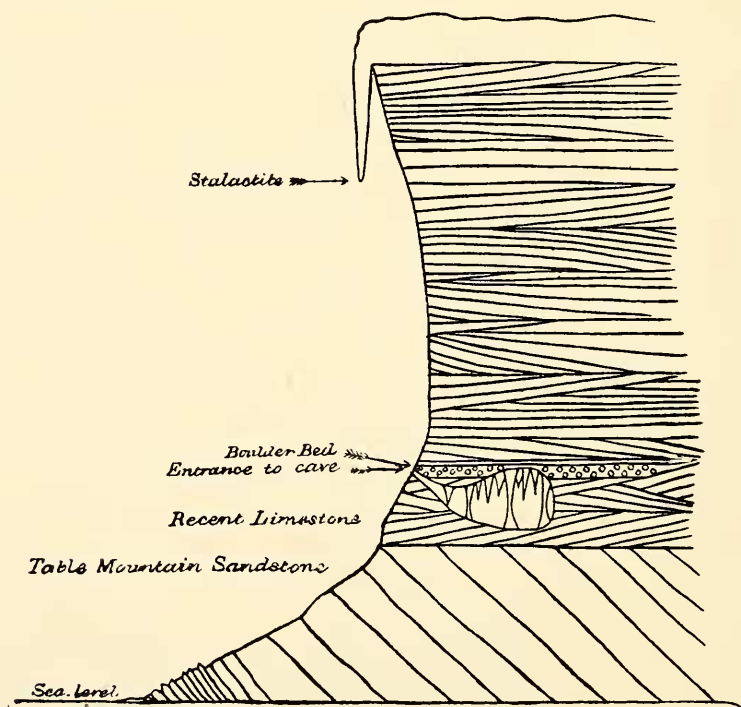


FIG. 2.—CAVE IN RECENT LIMESTONE NEAR CAPE INFANTA.

There is no running stream of water in the cave, although one may possibly have been there formerly, and would then have been the cause of its formation. The cave is on Mr. Paul Dunn's farm, and was discovered by him in 1847 when he tracked a leopard into it.

On the coast near Stanford Cove there is a cave known as the Kellers. It lies between the limestone above and the Table Mountain Sandstone below, although the opening is entirely surrounded by the latter rock. A stream of water issues from the opening. There are other and larger streams flowing from between the limestone and Table Mountain sandstone in the neighbourhood.

There is no doubt that this cave has been made by the water drained underground from the Strandveld, which is covered with sand and limestone. The water, which is said locally to have remarkable medicinal properties, tastes slightly brackish, and apparently in no way differs from the spring water met with at other places along the coast.